UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF A TRACTOR MOUNTED PEANUT HARVESTING EQUIPMENT

ELNOUGOMI ABDELGADIR OMER MUSSAD

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DEVELOPMENT OF A TRACTOR MOUNTED PEANUT HARVESTING EQUIPMENT

By

ELNOUGOMI ABDELGADIR OMER MUSSAD

Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Engineering
Universiti Putra Malaysia

January 2001

Dedicated

to

My

Parents ABDELGADIR, SKEENA
Brother and sister ABUBAKAR, NAHID
Wife, sons and daughter, MANAL, MUHAMMAD, MUHANAD, MRWA

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy.

DEVELOPMENT OF A TRACTOR MOUNTED PEANUT HARVESTING EQUIPMENT

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January 2001

Chairman: Associate Prof. Dr. Ir. Desa Ahmad

Faculty : Engineering

A peanut harvesting equipment suitable for operation by a 35hp tractor has been designed, developed and tested at the Department of Biological and Agricultural Engineering, UPM, Malaysia. The equipment consists of adjustable V-shaped digging blade where the angle of penetration can be easily adjusted with the help of bolts and nuts. Double discs lifter for gripping the loosened plant above the soil surface follows the digging blade. The loosened plant enters into a threshing mechanism, which consists of two cylinders with different number of fingers to achieve the stripping operation without dragging and clogging the pods then transfers them to the tank at the end of the equipment via a conveyor.

Light weight and durable materials were chosen to fabricate most of the peanut harvesting equipment parts. Therefore, in terms of weight, the equipment was lighter (about 315kg) compared with other existing machines (400kg). This facilitates easy hitching and transporting. Overall the peanut harvesting equipment was designed, fabricated, utilised and maintained using local resources and skill, with initial and fabrication cost of about US $1455.

Soil moisture content was significant parameter for harvesting peanut crop in a single operation. This new equipment was designed for higher soil moisture content. The previous machines were operated below 30% soil moisture content. It was also found suitable and efficient for harvesting peanut in rainy season.

During the tests the clay soil cause digging, stripping and cleaning problems. Hence the new peanut harvesting equipment was designed to provide proper and efficient digging blade (V-shaped) with the following added features: Suitable clearance between cylinders and their concave (35 mm), suitable spacing between concave bars (25 mm) and conveyor wire mesh (20 mm). Equipment performance test achieved good results on clayey soil (Serdang Series Soils). Results from the field test show that the equipment is suitable for harvesting peanut in a single operation. The total power requirement of a single row equipment was about 15kW (20hp).

The losses during digging, lifting, stripping and conveying were 6.23%, 8.65%, 5.06% and 1.96% respectively. Other peanut harvesters had higher digging and stripping losses (15% and % 9.3% respectively). The equipment pods breakage scored lower percentage at 1.91 % compared with the previous designed machines (about 8.9 %). Overall efficiency was 78.1%, considered high compared with other combines efficiencies.

The peanut harvesting equipment had an average capacity of 324.9kg/h. The maximum capacity reached by the equipment was about 377.3kg/h, while the previous designed harvester had a maximum capacity of 337 kg/h.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah.

PEMBINAAN ALAT PENUAI KACANG TANAH BANTUAN KUASA TRAKTOR

Oleh

ELNOUGOMI ABDELGADIR OMER MUSSAD

Januari 2001

Pengerusi: Prof. Madya Ir. Dr. Desa Ahmad

Fakulti : Kejuruteraan

Sebuah jentuai yang menggunakan traktor 35 kuasakuda telah direka dan dibangunkan di Jabatan Kejuruteraan Biologi dan Pertanian, Universiti Putra Malaysia.

Jentera ini mengandungi bilah penggali yang boleh dilaras berbentuk V manakala sudut penusukannya dikawal dengan melaras bolt dan nat Bilah penggali ini diikuti oleh cakera berkembar pengangkat bertujuan menarik tanaman dipermukaan tanah. Tanaman yang telah dicabut akan memasuki mekanisme peleraian yang mengandungi dua silinder berjejari bertujuan melerai

kekacang sebelum dihantar ke tangki dibelakang jentera menerusi alat pengangkut.

Bahan yang digunakan untuk membina bahagian jentuai adalah ringan dan tahan lasak. Berbanding jentera lain, jentera ini lebih ringan serta memudahkan pemasangan dan pengangkutan oleh sesebuah traktor.

Dalam operasi tunggal penuaian kacang tanah terutama dimusim hujan, kelembapan tanah merupakan faktor yang penting. Jentera ini direkabentuk untuk kegunaan ditanah basah dan melebihi 30% sebagaimana yang dilakukan pada jentera lain. Kajian telah dijalankan pada kelembapan 42% (asas kering).

Kajian ditanah liat menimbukan masalah galian, peleraian dan pembersihan. Untuk mengatasi masalah tersebut bilah penggali telah dipinda kebentuk V mana kala kelegaan diantara silinder dan pelantar diubahsuai untuk menghasilkan kecekapan yang lebih baik. Jumlah kuasa yang dihasilkan oleh sebuah jentuai kacang tanah bagi satu barisan adalah 15 kW (20 kuasakuda).

Dari aspek kehilangan, peratus kehilangan yang disebabkan oleh proses galian, pencabutan, peleraian dan pengangkutan adalah masing masing 6.23, 8.65, 5.06 dan 1.96 berbanding 15% dan 9.3% kehilangan galian dan peleraian oleh jentuai lain. Pecahan kacang juga menunjukkan nilai 1.91% berbanding 8.9% oleh jentera sediaada.

Keupayaan purata jentera adalah 324.9 kg/jam manakala keupayaan maksimum adalah 377.3 kg/jam berbanding 337 kg/jam yang dihasilkan oleh jentuai lain. Kecekapan keseluruhan adalah 78.1%.

Jentuai ini telah direka, dibina dan disenggara menggunakan sumber serta kepa karan tempatan. Kos pembinaan adalah US $ 1455. Memandangkan ia boleh beroperasi ditanah basah,ia dijangka sesuai digunakan dimusim hujan.

ACKNOWLEDGEMENTS

All praises and thanks are for Almighty Allah (S.W.T.) Whose countless bounties enabled me to accomplish this study, and invoke His blessings on the Holy Prophet Muhammad (S.A.W.) for whom He created this universe.

I would like to express my deep sense of gratitude to my chief supervisor, Assoc. Prof. Ir. Dr. Desa Ahmad, Deputy Dean, Academic and Student Affairs, Faculty of Engineering for his encouragement, guidance and concern throughout the period of this study. Despite the heavy pressure of work, he made himself available whenever I needed his help and advice. I gratefully thank him for all he did for me. I owe much more than can be adequately expressed here to my committee members, Dr. Azmi Yahya Head Department of Biological and Agricultural Engineering and Assoc. Prof. Dr. Shamsuddin Sulaiman, Department of Mechanical Engineering for their comments and suggestions in improving the draft.

This study was carried out under the Intensification of Research in Priority Area (IRPA) programme. I am heartily thankful to the Government and the people of Malaysia for the financial support and their generosity. I am grateful to Sudan Government for sponsoring the whole period of my study at Universiti Putra Malaysia.

Special thanks are extended to En. Mohamad Haji Ikhsan, of the Soil Machine Dynamics Laboratory, to En. Mohd Kamal Hashim and his staff of the

Services and Research Division, who helped me during the stage of fabrication. Thanks are also extended to En. Zainal Abidin B. Abd Ghani, Technical Assistance (Workshop Technology). Without their generous cooperation, support and facilities, this study would not have been possible.

Special thanks are extended to my wife, Manal, for facilitating my work. Completion of the dissertation would have been delayed without her understanding and support. I appreciate the concern of my sons, Muhammad, Muhanad, and daughter, Marwa for sacrificing the needed attention of their father. My special thanks to my parents for their constant prayer for my continued success in life. Special thanks are due to all those, whom I could not mention here, have contributed to the completion of this study through their physical, moral or spiritual support.

Praise is to the Almighty Allah (S.W.T.) Had it not been His will I would not have the patience to withstand the pressure of my research and completion of study would not have been possible.

May Allah (S.W.T.) bless all who has kindly helped the author! Amin.

I certify that an Examination Committee met on 5 January 2001 to conduct the final examination of Elnougomi Abdelgadir Omer on his Doctor of Philosophy thesis entitled "Development of a Tractor Mounted Peanut Harvesting Equipment" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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12 JAN 2001

This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy.

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I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

ELNOUGOMI ABDELGADIR OMER MUSSAD,

Date : 12 January 2001

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